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Development of IPM module for rhinoceros beetle (*Oryctes rhinoceros* L.) in juvenile coconut garden

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ABSTRACT

Coconut (*Cocos nucifera*) is an important crucial plantation crop and prone to many pests and diseases. Rhinoceros beetle (*Oryctes rhinoceros* L.) is an important pest that causes damage and reduce the yield. During 2018, Gaja cyclone affected the coconut plantations in delta regions of Thanjavur, Thiruvarur and Nagapattinm Districts. Rhinoceros beetle was found to inflict severe damage in replanted young coconut seedlings. The present study was carried out to mitigate the damage due to rhinoceros beetle in coconut gardens. Shoot damage of 14.07, 11.36, and 18.17 per cent was recorded in Module - I recommended practice, Module - II IPM and module - III farmers' practice respectively. The maximum shoot damage reduction of 37.48 per cent was observed over farmers' practice recorded in Module - II IPM followed by recommended practice (22.56%). Module - II IPM was found to be effective against rhinoceros beetles than recommended practice and farmers' practice.

Key words: *IPM module, Juvenile coconut garden, Rhinoceros beetle, Shoot damage*

Introduction

Coconut palm (*Cocos nucifera)* belongs to the palm family (Palmae) and one of the largest in the monocotyledon group. Coconut is economically important and used as both ornamental and food crop (Pham *et al*., 2016). Considering the adaptable nature and the multifarious uses, coconut is eulogized as KALPAVRIKSHA (Tree of Heaven). In India, coconut is one of the most crucial plantation crops. India ranks third in the world with a total cultivated area of 1975.81 thousand hectares and a production of 21,665 million nuts (Kalimuthu and Raghavi, 2019). *Oryctes rhinoceros* known as the rhinoceros beetle or black beetle which is serious pest of coconut in all coconut cultivating regions (Rajan *et al*., 2009). Adult beetles feed on the soft tissues of the growing region and make burrows in unopened fronds. The opened leaves have a distinct 'V' shaped geometric cut and the pest occurrence during early phase on juvenile palms highly prevent the good establishment of the palm (Josephrajkumar *et al*., 2015). Disease, pest or lightening affected dead standing trees serve as breeding site for immature beetles (Bedford, 1980). Adults spend most of their life time on fresh plants, however they return to decomposing sites for mating and reproduction (Josephrajkumar *et al*., 2015). During 2018, Gaja cyclone affected the coconut plan-

tations in Thanjavur, Thiruvarur and Nagapattinam Districts. The trees were felled and uprooted and the farmers are replanting the coconut seedlings. The rhinoceros beetle cause severe damage in replanted young coconut seedlings. The farmers are used chemicals to manage the rhinoceros beetle damage but not control the rhinoceros beetle incidence. Hence the integrated pest management was followed in Gaja cyclone affected area in Thanjavur District.

Materials and Methods

Field experiment was carried out to in Alathur village, Madukkur block, Thanjavur District from December 2020 to October 2021. An integrated pest management (IPM) module was followed in the East Coast Tall (ECT) variety of coconut gardens of five hectare area. Three modules were attempted for the management of rhinoceros beetle *viz*., Module I was recommended practice, module II was integrated method and module III was farmers practice. Each module had seven replications and each replication had ten seedlings. Totally seventy seedlings were adopted per module. In Module - I recommended practice, the dead and decaying fronds were removed and destroyed. Mixture of neem seed kernel powder + sand (1:2) @ 150 g per palm was applied at the base of the three innermost leaves in the crown. Naphthalene balls 12 g (three balls) were placed in the leaf axils once in 45 days. Adult beetles were hooked out from collar region and copperoxy chloride fungicide was applied in the holes. Rhinolure pheromone traps installed @ 2 nos/ac. and the beetles trapped were killed. Chlorpyriphos 1.5% DP @ 5 g mixed with 100 to 150 g sand was applied on the innermost three leaf axil beneath the spindle leaf once in two months. In module - II Integrated method, pit guard plus collar guard were placed around the seedlings and near collar region respectively per seedling with fipronil 0.3 GR @ 25g/seedling mixed with 1 kg of sand and applied in the planting pit during planting. In juvenile garden, dead and old fronds were removed. Neem seed powder plus sand (1:2) @ 150 g/seedling was applied at the base of three innermost leaves of crown of the seedlings. Adult beetles were hooked out from collar region. Rhinolure pheromone trap installed @ 2 traps/ac to trap the beetles. *Pleurotus sajor caju* consortium 250 g + 5 kg urea was applied over dead wood logs and malathion 50 EC @ 5ml/lit. was applied in decaying or fallen coconut logs. In farmers practice, 0.25 D cypermethrin @ 5 g/seedling was applied inside the planting pit during planting. Monocrotophos 36 SL @ 2.5 ml/l. applied in the crown region of the seedling once in 45 days. Shoot damage was observed at monthly interval and shoot damage was worked out.

$$\text{Shoot damage (\%)} = \frac{\text{No. of damaged shoots}}{\text{Total number of shoots}} \times 100$$

Results and Discussion

Shoot damage of 14.07, 11.36 and 18.17 per cent was recorded in Module I - recommended practice, module II - IPM and module III - farmers practice respectively. The shoot damage recorded in module - I recommended practice, module II IPM and module III framers practice were ranged from 8.62 to 17.45, 6.52 to 15.58 and 10.93 to 26.66 per cent respectively. The minimum shoot damage was recorded in module - II IPM (11.36%) followed by module – I recommended practice (14.07%) and module – III farmers practice (18.17%). The maximum shoot damage reduction of 37.48 per cent was observed over farmers practice recorded in Module - II IPM followed by recommended practice (22.56%) (Table 1). In module II - IPM physical barrier, pit guard plus collar guard combined with fipronil application inside the planting pit and sanitation method like removal of dead and old fronds might have protected the seedlings from rhinoceros beetle attack. Mixture of neem seed powder with sand placed in 3 inner most leaves of the crown might acted as a prophylactic method. Mechanical method like hooking out of live beetles from crown region could have reduced the population of the beetles. Application of fipronil with sand might have reduced the shoot damage of the rhinoceros beetle. Pheromone trap with rhinolure could have attracted the beetles. The mean trap catches recorded ranged from 1.0 to 4.0 nos/trap and high trap catches was recorded in the month of August 2021. *Pleurotus sajor-caju* consortia mixed with urea and applied on the left over wood logs could decompose the woods and could have reduced the breeding sites. Malathion killed the grubs in felled decomposed woods and reduced grub populations. Shoot damage recorded was 14.07 per cent in module - I recommended practice the removal of dead and decaying fronds could reduced the breeding sites. Application of the neem seed

Table 1. Evaluation of IPM modules for rhinoceros beetle in juvenile garden

Treatments	Shoot damage (%) by rhinoceros beetle						Mean	Reduction over FP (%)
	May 2021 (5 MAP)	June 2021 (6 MAP)	July 2021 (7 MAP)	Aug 2021 (8 MAP)	Sep 2021 (9 MAP)	Oct 2021 (10 MAP)		
RP	8.62 (17.05)[b]	12.75 (20.90)[b]	13.99 (21.95)[b]	15.22 (22.95)[b]	16.37 (23.85)[b]	17.45 (24.67)[b]	14.07 (22.01)[b]	22.56
IPM	6.52 (14.72)[a]	8.23 (16.60)[a]	11.19 (19.52)[a]	12.56 (20.74)[a]	14.10 (22.03)[a]	15.58 (23.24)[a]	11.36 (19.68)[a]	37.48
FP	10.93 (19.27)[c]	14.64 (22.48)[c]	17.17 (24.46)[c]	18.91 (25.76)[c]	20.73 (27.06)[c]	26.66 (31.07)[c]	18.17 (25.22)[c]	-
CD	1.11	1.17	0.91	0.70	0.88	1.03	0.50	-
SE(d)	0.50	0.53	0.41	0.32	0.40	0.47	0.23	-

MAP - Months after planting; RP- Recommended practice; IPM- Integrated Pest Management; FP- Farmers practice. Mean of seven replications. Values in parenthesis are arc sine transformed values. In columns, mean followed by a different letters are significantly different by 5% level (DMRT Test)

powder mixed with sand protected the seedlings against the beetles. Naphthalene balls placed and covered with sand repelled the beetles. Mechanical method like hooking out of live beetles from crown region reduced the population of the beetles. Pheromone trap with rhinolure attracted the beetles effectively. The mean trap catches recorded ranged from 2.0 to 5.0 nos/trap and the trap catches was high during August 2021. Chlorpyriphos mixed with sand reduced the shoot damage. Compared to module - II and module - I, module - III farmers practice recorded maximum shoot damage (18.17%) whereas cypermethrin applied in the planting pit was effective against young seedlings. Monocrotophos applied in the crown region of the seedlings killed the beetles through systemic and broad spectrum mode of action. However, seedling damage increased on the reduction of the efficiency of monocrotophos.

The present study revealed that shoot the damage in IPM was significantly less followed by recommended and farmers practice. The reduction of shoot damage in Module - II IPM might be due to the integrated application of cultural, mechanical, physical, biological and chemical control. Nair (1975) reported that effective control of rhinoceros beetle could only achieved by combining various control measures such as cultural, mechanical and chemical. Srinivasan *et al*. (2018) stated that adoption of integrated pest management (IPM) practices in coconut would provide tremendous reduction in rhinoceros beetle damage on coconut leaves and spindles.

References

Bedford, G. 1980. Biology, ecology, and control of palm rhinoceros beetles. *Annual Review of Entomology.* 25 (1): 309-339.

Josephrajkumar, A., Chandrika, M. and Krishnakumar, V. 2015. Management of rhinoceros beetle. *Indian Coconut Journal.* 58 (7): 21-23.

Kalimuthu, K. and Raghavi, M. 2019. Review on area, production and productivity of coconut in India. *International Journal of Research in Business Management.* 7 (1) : 1-6.

Laura J. Pham, 2016. Coconut (*Cocus nucifera*). *Industrial Oil Crops*. 231-242p.

Nair, C., Daniel, M., Ponnamma, K., Nambiar, K. and Nair, M. 1997. Integrated pest management in palms. Coconut Development Board, Kochi, India, 30p.

Rajan, P., Chandrika Mohan., Nair, CPR. and Josephrajkumar, A. 2009. Integrated Pest Management in Coconut. *Technical Bulletin* No. 55 (ICAR-CPCRI): 20p.

Srinivasan, T., Rajamanickam, K., Mohan, C. and Maheswarappa, H. 2018. Validation of integrated pest management strategy against coconut rhinoceros beetle, *Oryctes rhinoceros* L. (Scarabaeidae: Coleoptera). *Journal of Plantation Crops.* 46(1): 8-11.